

From the (Iron) Horse's Mouth:
An updated Roster from
Ross Winans' *Memorandum of Engines*

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This book discusses the locomotive engines of Ross Winans of Baltimore, using data from primary sources. It presents a listing of two hundred and sixty seven engines delivered to twenty-six American railroads during the period 1843 through 1863. It is partially derived from a transcription of his *Memorandum of Engines* from his personal pocket notebook, in the possession of the Maryland Historical Society, Baltimore.¹ The material here supplements, corrects, and updates previously published rosters of the output of Winans' deliveries. It is not necessarily a complete, definitive, nor comprehensive roster of the output of Winans' shops. It should be noted that not all of the delivered engines were accepted, and that in some cases, the engines were returned and sold to other roads. Thus, there is some duplication in the list which we attempted to resolve by cross-checking rosters and other primary sources. In addition, a series of Winans' Patents are presented, which show the chronological development of his railroad motive power concepts.

When the Baltimore & Ohio (B&O) Railroad reached Cumberland, Maryland, in 1842, it found a series of short line railroads in place.² From the standpoint of the western counties of Maryland, it made sense to establish a transportation infrastructure to meet with the B&O railroad, and the Chesapeake & Ohio (C&O) canal. Two of the three early railroads in Allegany County, Maryland, purchased Winans equipment. The other line purchased engines from Baldwin and Smith & Perkins, but used Winans' wheels, axles, and cars. Most of these engines later transferred to the Cumberland & Pennsylvania (C&P) Railroad upon its acquisition of the shortlines. These engines were rebuilt and maintained by the Mount Savage Locomotive Shops of the C&P railroad, under the able direction of Master Mechanic James A. Millholland. In addition, the B&O had at least eight Winans engines assigned to work on the Eckhart Branch Rail Road of the Maryland Mining Company. That line connected with the B&O in Cumberland in 1846.

The small pocket notebook is written in Winans hand, and is remarkably legible. It has entries only for the period June 8, 1848, to May 3, 1855, so it does not cover the entire production of Camel engines by Winans. There is a gap in dates between adjacent entries of September 1854 and March 1855. It is not known if this indicates a lack of deliveries, but it was during this period that Winans got married for the second time, following the death of his first wife. Winans' spellings vary somewhat, and have been corrected as required.

Entries in the notebook discuss the cost of materials, labor hours, purchases of raw iron and metal working tools, customer and supplier addresses, sales, and delivery of engines to various companies.

Little technical information is given in the notebook, except when new features are introduced. Some terms of sales are given, as well as contract dates and terms. Other material in the Winans collection held by the Maryland Historical Society includes additional information on the sales, repairs, construction, and other aspects of Winans' business, as well as personal papers and a biography.³

We decided to transcribe, correlate, and publish the broader information in the Winans notebook to aid other researchers.⁴ Starting with the records of the delivery of one hundred and ninety two engines to seventeen companies listed in the notebook, our next step was to fill in the periods before and after the notebook coverage, and account for the gaps. This was done using previous Winans lists and rosters and reports of the various customer railroads.⁵

Ross Winans was a man of wide ranging interests, and his writings include political and religious tracts, extensive notes on his shipbuilding ventures, and his work as a water commissioner for the city of Baltimore. He was a fervent supporter of States Rights during the Civil War, and served in the Maryland House of Delegates. He was forcibly removed from a train by Federal troops as he was returning from a meeting of the Assembly in Frederick, and was interned briefly at Fort McHenry. He was also involved in a steam powered cannon, which was intercepted on its way south by Federal troops near the Thomas Viaduct at Relay, Maryland. He changed focus from steam locomotives to steam ships during the civil war, building some in Maryland, and others in England and France. Of a unique design, the spindle-shaped Winans *Cigar ship* may have been Jules Verne's inspiration for the Nautilus in *Twenty Thousand Leagues Under the Sea*. A vast amount of dealings in railroads and ships, including war ships, was done with Imperial Russia. This fascinating and talented individual of wide ranging interests has not yet been treated to a comprehensive biography that does him justice.

Winans was associated with the B&O from the very beginning of the application of steam power.⁶ He served as the assistant engineer of machinery in 1831 under Chief Engineer Jonathan Knight. He formed the company Gillingham & Williams around 1836 to operate the locomotive manufacturing shops at Mt. Clare that had belonged to Phineas Davis. Davis, of York, Pennsylvania, had built many of the early B&O engines, and was killed while road testing a locomotive.

Table 1 lists Winans' customers. The B&O was his largest locomotive customer, with 140 of the listed deliveries going to that road.⁷ His shops were co-located with the B&O facilities at Mt. Clare, in Baltimore. As a result of a disagreement with Mr. Henry Tyson, then Master of Machinery of the B&O, over design issues, the B&O bought no more Camel engines from Winans after 1857⁸. He closed his shop at Mt. Clare, which stood idle and was eventually sold to Hayward & Bartlett. The B&O did acquire three Camel engines left in the shop in 1863, needed because of war-time shortages of motive power. Winans' second best customer was the Philadelphia & Reading. These two customers represented 70 percent of sales, with the remaining 30 percent spread among twenty-three different companies. A thirty-day trial period at the customer site seems to have been the norm. In some cases, both a delivery and an acceptance date are given in the notebook.

Table 1

Winans Motive Power Deliveries, Alphabetical by company

Baltimore & Ohio	140
Baltimore & Susquehanna	10
Boston & Maine	1
Boston & Worcester	1
Canandagua & Elmira	2
Cleveland & Pittsburgh	1
Cumberland Coal & Iron	3
Cumberland & Pennsylvania	5
Dauphin & Susquehanna Coal	4
Delaware, Lackawana, & Western	6
Gouverneur Morris of Morrisania	1
Huntington & Broad Top Mt.	2
Maryland Mining Co.	3
Mt. Savage Iron & Coal	4
Mt. Savage Rail Road	1
New York & Erie	2
New York & New Haven RR	2
Northern Central	10
Pennsylvania RR	11
Philadelphia & Columbia	2
Philadelphia & Reading	47
Pittsburg & Connellsville	1
Shamoken Valley & Pottsville	1
South Carolina	1
Trevorton & Susquehanna	1
Western Massachusetts	<u>4</u>
total	267

Technical Analysis

The majority of the Winans engines were *burden* (freight) as opposed to passenger type. The early models are sometimes referred to as "the Baltimore engines." Engines delivered after June 1848 are almost all of the Camel 0-8-0 type, favored by Winans. This class of engine did extremely well in low speed, heavy load operations. Thus, they were ideally suited for coal haulers, and not particularly well suited for passenger or flat track service. Design deficiencies of the Camel series are noted in White.⁹ For their reported faults, the Camels gave good service, with a low failure rate. Winans held a series of basic patents for locomotive and car design, and he defended his patent rights vigorously in court.¹⁰ One major advantage of the Winans engine was the variable steam exhaust, a feature he reserved to his own construction. He strongly advocated the superiority of the Camel design, even when the B&O specified a different design. Winans did not acknowledge the value of the leading or pilot truck. He shut down his business rather than change his mind. By that time, he had made enough money in his locomotive business to allow him to pursue other interests, such as his "Cigar" steamship. According to an entry in the Winans notebook, the introduction of anthracite burning engines came with the delivery of the *New Jersey* to the Philadelphia & Reading in March of 1852. Previous sources credit this distinction to the *Delaware*, delivered to the Philadelphia & Reading in October of 1846.¹¹ The B&O had a preference for engines burning Cumberland coal, a bituminous product available in seemingly inexhaustible quantities along their line,

Locomotive Deliveries

In compiling this list, we noted engine deliveries under the name of the entity that accepted delivery. For example, sales to the Baltimore & Susquehanna, and the subsequent Northern Central, are listed separately. The following sections give a brief background on the customers for Winans' engines. These are presented in alphabetical order.

Baltimore & Ohio. The notebook and William D. Edson's B&O rosters are in general agreement.¹² The Camel name derives from the first of class of that name, delivered to the B&O in 1848. All Camel engines were of the 0-8-0-wheel arrangement. The notebook lists 109 B&O units. The B&O roster lists 119 Camels from 1848-1860, with 3 more in 1864. The notebook does not include units 210 to 219, and 188, 199, 204, and 235 (delivered in 1864). The later engines were those left in the Hayward and Bartlett shops. Unnamed engines mentioned as delivered in September of 1850 in the notebook were probably the *Phoenix* and *Apollo*. Discrepancies exist in three engines. The notebook does not mention No. 179, which is listed in the B&O roster as coming from Winans. In addition, the Winans notebook shows delivery of engines No. 150 and No. 152, which are credited to Lawrence in the roster.

Of the Winans engines delivered to the B&O, 124 were Camels, 12 were "mud-diggers", three were of type 4-4-0, and one was of type 4-8-0. An example of a "mud-digger" can be viewed at the Mt. Clare facility of the B&O Railroad Museum in Baltimore. Unfortunately, no examples of the Winans Camel survive. B&O number 217, a derivative Hayes Camel, is preserved and on display at the B&O Museum at Mt. Clare in Baltimore.

Baltimore & Susquehanna. The data in the notebook lists ten deliveries to the Baltimore & Susquehanna (B&S), which is in general agreement with the data in the B&S roster.¹³ The engine delivered on February 14, 1852, unnamed in the notebook, was probably B&S No. 5. The engine delivered on October 28, 1851, may have been the *John S. Gittings*, obtained from the Maryland Mining Company (MMC) as its *Fire King*. Of all of the MMC engines, this one alone does not show up in later rosters, in the transitions to the Cumberland Coal & Iron Company, and later to the Cumberland & Pennsylvania Railroad. The notebook has an entry for this sale that reads, “engine sold them from Maryland Mining Co., \$8000 cash.” If it were the *Fire King*, that engine had gone to MMC on June 30, 1851, and so had not been in service for very long. No reason is given for the sale.

James A. Millholland, Master Mechanic of the Cumberland & Pennsylvania line, had a father, also named James, who was associated with the Baltimore and Susquehanna from 1838 to 1848. This appears to have been prior to the delivery of the first Winans product to that road. The Baltimore & Susquehanna later became the Northern Central.

Boston & Maine. One delivery in 1849 is recorded. No Winans engines are rostered.¹⁴ White mentions that the Boston & Maine tested an engine in November of 1849, but did not find it satisfactory. It was rejected, and sold to the Philadelphia & Reading. It is not known which P&R engine this became.

Boston & Worcester. Only one Winans unit was delivered to this road, and it was unusual in having a single set of seven-foot diameter drivers. Disposition of the unit is unknown.

Canandagua & Elmira. Two units went to this line, located in the Finger Lakes region of Western New York State. They were sold to the Northern Central in 1867, and wound up on the Cumberland & Pennsylvania in western Maryland. The Elmira & Canandagua (E&C) became the Elmira, Jefferson, & Canandagua that went to the Erie, then to the Pennsylvania. These engines are not shown in the 1856 report of the E&C to the New York State Railroad Commissioners.¹⁵ These engines must have been acquired between 1856 and 1863. There is no mention of them in the notebooks, whose entries end by 1855.

Cleveland & Pittsburgh. The sales of two units to this road in 1852 are recorded, according to White. They are not mentioned in the Winans notebooks. They may be included with the engines delivered to the B&O.

Cumberland Coal & Iron. Located in Allegany County, Maryland, this company operated the Eckhart Branch, a rail line from the coal mines at Eckhart, to connections with the B&O railroad and the C&O Canal at Cumberland. The Cumberland Coal & Iron (CC&I) Company was the successor to the Maryland Mining Company. Chartered in 1850, it purchased the Maryland Mining Company’s mines and railroad property in April 1852. Cumberland Coal & Iron was in turn acquired by the Consolidation Coal Company in 1870. At that point, the Eckhart Branch became part of the Cumberland &

Pennsylvania Railroad, also owned by Consolidation Coal. Three Winans sales to CC&I are recorded, and two of the three original Maryland Mining Company's Camels were also on the roster of that line.

The Cumberland Coal & Iron engine delivered on September 20, 1852, is mentioned by Winans to be the same as B&O units No. 106 and 108. B&O engines No. 161, 162, and 163 saw service on the Cumberland Coal & Iron's branch, and have the same specifications. In fact, at least eight of the engines delivered to the B&O appear to have been earmarked for service on the Cumberland Coal & Iron's Eckhart Branch. Remarks in the Winans notebook mention engine B&O No. 161 as the sixth, No. 162 as the seventh, and No. 163 as the eighth for use by the CC&I. No mention is made of the first five, nor of the 9th. or 10th.

Cumberland & Pennsylvania. The C&P rostered 16 of the Camel units.¹⁶ They were mostly acquired from predecessor roads. James Millholland, the C&P Master Mechanic, was familiar with keeping these Camel engines running, and making improvements to them.¹⁷ The C&P also acquired two engines second-hand from the Northern Central, which had been acquired by that road from the Elmira & Canandagua Railroad of New York in 1867.

Dauphin & Susquehanna Coal. Four sales to this company are recorded. Following bankruptcy, the Dauphin & Susquehanna Coal (D&SC) Company railroad reorganized in 1859 to the Schuylkill and Susquehanna Railroad.¹⁸ They rostered two Winans engines, the *Gold Mine*, and the *Baltimore*. These are not listed as Winans products, but do have the 0-8-0 wheel arrangement. The *Baltimore* may have gone to the Philadelphia & Reading as number 346 in 1872. The *Gold Mine* became P&R No. 294 in 1866.

Delaware, Lackawanna, & Western. Six Winans units went to this company. They were all of a 6-foot gauge.¹⁹ Most were scrapped by 1859, but the first unit delivered in 1854 survived the longest, until 1878.

Gouverneur Morris of Morrisonia. One engine delivery is listed in the Winans notebook to this individual who was the son of a famous Revolutionary War figure. He inherited the family estate, Morrisonia, consisting of a modest 1,920 acres in New York's Westchester County, occupying the southwestern corner of what is now known as *The Bronx*. Morris' name does not appear on the boards of any major railroads of the time. He was probably acting as a financier for some railroad venture, a common practice of the time.

Huntington & Broad Top Mountain. Two Winans engines went to the Huntington & Broad Top Mountain (H&BTM) Railroad in southwestern Pennsylvania in 1863.²⁰ One unit suffered a boiler explosion in 1868, resulting in the loss of four lives. This railroad follows the Raystown Branch of the Juniata River along the west side of Broad Top Mountain, which is best known for the neighboring narrow gauge line on its east side, the East Broad Top Railroad.

In the 1880s, the Pennsylvania Railroad (PRR) interchanged with both the Cumberland & Pennsylvania Railroad and the Georges Creek & Cumberland Railroad at State Line, near Ellerslie, Maryland. At times, up to 15 trains of coal cars per day were handled. The loaded cars were hauled over the Bedford & Bridgeport Railroad, then controlled by the PRR, to the H&BTM at Mt. Dallas, Pennsylvania. The traffic went by that road to Huntington, and the connection with the PRR main. Thence, coal went to the dock at South Amboy, New Jersey. The H&BTM hauled more of the Georges Creek coal from Maryland than it did the product of its local mines.

A highly profitable operation, the H&BTM was an acquisition target of the PRR. When the shareholders declined to sell, the PRR built an alternate line (the Bedford & Hollidaysburg), that strangled the coal lifeline of the H&BTM. The H&BTM operated until 1954, and a portion then survived as the Everett Railroad.

Maryland Mining Company. The Maryland Mining Company (MMC) was incorporated in Maryland on March 12, 1829. The company built a railroad from Eckhart, near Frostburg in Allegany County, to the Will's Creek, at the west end of the Narrows near Cumberland, a length of 9 miles. The tracks then joined those of the Mount Savage Rail Road to pass through the Narrows and into Cumberland, to connect with the B&O. The Maryland Mining Company Rail Road was later extended as the Potomac Wharf Branch (14 miles total). Three deliveries of Winans engines are recorded. Two of the engines went to Cumberland Coal & Iron when it purchased the property of the MMC in 1852. One unit evidently was sold to the Baltimore & Susquehanna.

Mount Savage Iron & Coal. This line, with four Winans engines, became part of the Cumberland & Pennsylvania Railroad, along with its engine previously acquired from the Mount Savage Rail Road. The disposition of their engine *New York* is not known. An engine of that name is rostered on the Cumberland & Pennsylvania, but is listed as having come from Hayward & Bartlett.

Mount Savage Rail Road. The 10 mile long Mount Savage Rail Road was completed to Cumberland, Maryland, in 1845. One Winans sale is listed to this entity. The Cumberland & Pennsylvania Railroad took over the Mt. Savage Coal & Iron Company in 1848, and the railroad in 1854. The engine became C&P No. 1.

Rail for the Mount Savage Rail Road was produced locally from the mills at Mount Savage, breaking the English monopoly on rail manufacturing. The B&O purchased rail from the Mt. Savage Works to update their main line near Harper's Ferry.

Winans supplied rolling stock to this line as well. One of his earliest patents was for a coal car that could carry more than its own weight (capacity greater than tare weight). Four-wheel cars were supplied from 1845-1850. In 1854, the norm was a three-axle hopper of three tons tare weight.

New York & Erie. Two sales to this entity were noted by Winans, and confirmed in the roster compiled by G. Best.²¹ Winans mentions that No. 89 was shipped to Piermont

(NY) via the Bark *Laurel*. The engine was evidently assigned to their Delaware Division as a pusher on the grade out of Susquehanna.

New York & New Haven Railroad. Two deliveries were logged to this line, but no Winans engines were rostered.²² They may not have been found acceptable, and were returned. The NY & NH, being flat, would have had little use for the plodding low speed, heavy haul Camel class of engine.

Northern Central. Ten Winans sales are recorded to this line, in addition to the engines they acquired from the Baltimore & Susquehanna.²³ Two units came from the Elmira & Canandagua, and were subsequently sold to the Cumberland & Pennsylvania. The Northern Central line also inherited Shamoken Valley & Pottsville number 4, as their No. 57.²⁴

Pennsylvania Railroad. Eleven sales are recorded to this line, and confirmed with their roster.²⁵ Winans referred to the engine *Mohawk* as No. 140, but it is rostered by the line as No. 130. These units were subsequently rebuilt at the Altoona Shops as Moguls (2-6-0). Mr. C. H. Caruthers, Superintendent of the Car Department of the Westmoreland Coal Company, did a set of as-built drawings for the Camel engines at that time.

Philadelphia & Columbia. Two sales to this line were noted by Winans.²⁶ The railroad was called the Philadelphia & Columbia at the Philadelphia end, and the Columbia & Philadelphia at the Columbia end. One engine is an 0-4-0 Crab, and the wheel arrangement of the other is not listed, although it is a 15-ton engine,

Philadelphia & Reading. As noted previously, this line was Winans' second best customer. The P&R engine *Susquehanna* is detailed in White. James Millholland was associated with the Reading from 1848-1866. He gained extensive hands-on experience in repairing, modifying, and upgrading Camel engines. His son, James A., became Master Mechanic of the C&P. The notebook is in generally good agreement with Thomas Taber's roster.²⁷ The engine *America*, mentioned in the notebooks as being delivered to the P&R on October 1, 1850, is not mentioned in any of the P&R rosters. The engines *Raush Gap* and *Yellow Spring* were mentioned in the notebooks as being delivered to the Dauphin & Susquehanna Coal Co, but show up on the P&R roster. It should be noted that the P&R specified engine weights in *long tons* of 2,240 pounds.

Pittsburg & Connellsville. The Pittsburg & Connellsville No. 3 was a Camel, delivered in April of 1857. This may have been ex-B&O No. 188. It shows up on the 1875 B&O roster as #703. The P&C was taken over by the B&O, then the C&O. (The common spelling of the city name was later changed to 'Pittsburgh').

Shamoken Valley & Pottsville. (Pennsylvania) Their engine No. 4 was a Winans, bought in 1858 by the predecessor Philadelphia & Sunbury as their #57. It later became Northern Central No. 57 in 1863.

South Carolina. The 4-4-0 engine *Rough & Ready* was delivered in 1847 at a cost of \$8142.11. It was numbered 6, and no further sales to the line are noted. The engine was

considered "a little too rough, and seldom ready." ²⁸ It was rebuilt in 1851, and scrapped in 1855.

Trevorton & Susquehanna. A single entry in the notebook shows the sale of a Camel engine to this line on July 12, 1854. The entry mentions that this is the second engine delivered, but evidence of other deliveries could not be located.²⁹ This line, in Northumberland County, Pennsylvania, was a 1854 reorganization of the Trevorton, Mahoney, & Susquehanna railroad, with 15 miles of track. It reorganized to become the Trevorton Coal & Railroad Company in 1856, the Trevorton Coal Company Railroad in 1860, and the Zerbe Valley in 1867. The line finally became the Mahoney & Shamoken Railroad in 1870.

Western Railroad of Massachusetts. Three or four sales in the 1842 time frame are attributed to Baldwin, building engines under license to Winans.³⁰ These were of the upright boiler *Crab* type, constructed to burn anthracite coal.

Economic Analysis

Most of the Winans Camel engines sold for around \$10,000. The price was less for cash transactions, and interest was added for deferred payments. Mr. Winans could not afford (or was unwilling) to finance all of the sales. Syndicates of what we would now be called investment bankers, such as Enoch Pratt or Gouverneur Morris expedited locomotive sales. They and their friends had ready access to large amounts of cash, which the banks of the time did not. The commercial banking industry was in its infancy. At an average of \$10,000 per unit, the one hundred and ninety two engines listed in the notebook represent almost *two million* 1850-dollars in gross sales. ³¹ In this time frame, there were no corporate or personal income taxes. Interestingly, volume customers such as the Baltimore & Ohio Railroad do not seem to get much of a price break. Besides his engine sales, Mr. Winans and two of his sons were involved with the construction of railroads in Russia, for the Imperial Government of the Czar. Winans may have sold as much or more equipment in Russia as he did in the United States. This contract allowed his son to construct, furnish, and maintain an estate near Baltimore named "Alexandrovsky." The contents of the estate were sold at auction after his death. Luckily, twenty-three boxes of Winans papers and journals were donated to the Maryland Historical Society for safekeeping. ³² Part of his estate now comprises Leakin Park in Baltimore.

The 26th Annual Report of the B&O, 1852, includes a section by General Superintendent William Parker. It mentions that ten Winans locomotives were purchased before October 1851 for a per-unit price of \$9,750. Twenty-one more were purchased after September 1851 at the same price. At the time, there were twenty-five locomotives under contract, but not yet delivered. That is quite a backlog. At the time that Winans was getting \$9,750 for his engines, the B&O was building locomotives in its shops for \$9,500. Winans included patent fees in his pricing.

The information exists in Mr. Winans' notes to calculate the materials cost and labor hours required for construction of an engine. This was not attempted as part of this

current effort, and was left as an exercise for the future. Much data remains to be mined and analyzed from this collection

Design Details

Details of the Camel design and construction can be found in White, and in the Winans patents. The locomotives came in three basic configurations: the short, medium, and long firebox configurations. Firebox widths were uniformly three feet, six inches. The furnace, as Winans terms it, was six feet long in the short model, for a grate area of 21 square feet. The medium model had a seven foot long furnace, for a grate area of 24 ½ square feet, and the long model had a eight foot, two inch long firebox, for a grate area of 28 ½ square feet. The long furnace model's firebox, being more than eight feet long, required lever-operated chutes for the fireman to feed the front of the fire. The fireman worked in the tender, as the firebox was behind the drivers. This design required that the drawbar passed beneath the firebox, and it typically heated to a cherry red color. Even after rebuilds with a more conventional cab design, the fireman worked in the tender.³³

An example of the short furnace model is B&O No. 55, the prototypical Camel. Examples of the long firebox model include B&O road numbers 210 through 219. Most of the Camels produced were the medium firebox models. The most distinctive feature of the Camel was the cab atop the boiler. They had slide valves, and used staybolts in the boiler.

All of the Camel boilers were forty-six inches inside diameter, and constructed of single riveted, 5/16 inch iron plate. They contained one hundred and three tubes, two and one-half inches outside diameter, and fourteen feet, one and one-quarter inches long. The steam dome was forty-one and one-half inches in diameter. The engine frame was constructed of 5/8 inch iron. A steam expansion ratio of two was used, with a boiler pressure around one hundred psi. The typical engine weighed 22.5 long tons (2,240 lbs. each). It was of a 0-8-0 wheel arrangement, with 43 inch drivers. The wheel base was 11 feet, three inches. The *Camel* engine was usually painted green.

Camel tenders were eight wheeled, generally with brakes on the rear truck only. They held five tons of coal, and eight and one-half tons of water (more than 2,000 gallons). Fully loaded, the tenders weighted 23 tons, only four tons less than the locomotive.

Maintenance and Service Life

The records of the Philadelphia & Reading contain detailed information on engine mileage's and rebuilding.³⁴ This line received a series of forty-eight deliveries from 1846 to 1855. By 1858, The P&R had racked up in excess of 3.5 million miles on 44 engines. The Camel fleet represented 20 percent of the P&R motive power roster. In 1865, 28 of 48 engines had not yet been rebuilt. By 1870, only four of the 48 were not yet rebuilt. Those four represented approximately one million miles of road service. The average service life before a rebuild was about thirteen and one-half years. Similar, but less comprehensive data for the B&O gives an average service life of eight and one-half years

before rebuilding.³⁵ The P&R registered a large number of rebuildings in the years 1869 and 1870, representing about 25 percent of the Camel fleet per year.

Most of the C&P Camels were rebuilt at the Mount Savage Shops, some twice. A total of 15 Camel rebuilds are recorded at the C&P shops, from 1866 through 1875.

Performance

The *Camel* engines were designed to be low-speed, heavy haul units. The speed was limited to 10 to 15 miles per hour by the steam capacity of the boiler, and the lack of a pilot truck. However, at that speed, a single *Camel* could haul a 110 car train of loaded coal hoppers on the level. To support his assertion that the Camel engines were less costly to operate than the alternatives proposed by Tyson, Winans used the B&O's own figures from their annual reports.³⁶ He cites 109 Camel engines, in service from their introduction to October 1, 1855, operating a total of 5,402,899 miles, at an average of 17,074 miles per year per engine. Winans calculates the repair cost per miles as nine and 31/100 cents. Using the next year's data, to October 1, 1856, the total mileage covered by the B&O's Camel fleet was 7,437,896 miles, an average of 17,483 miles per engine per year. Winans calculated the maintenance cost per engine at nine and 93/100 cents per mile. Given that most of the Camels were employed on the B&O's Third Division, the mountainous terrain west of Piedmont (Virginia, later West Virginia), and worked heavy coal drags, the cost numbers seem rather reasonable.³⁷

The B&O's Third Division was dominated by the Seventeen Mile Grade. The performance of a Camel engine on this grade was 144 trailing tons. Based on a tare weight of three tons for the Winans-designed six-wheel hoppers in use in 1854, a Camel would be rated at 48 hoppers. The limiting factor was probably more the manual brakes used on the loaded cars on the downgrade, and the skill and dexterity of the brakemen.

According to the 18th Annual Report of the Company, dated October 1844, a single Camel could handle a train of 1,100 trailing tons on the level, and 170 trailing tons at eight miles per hour on a grade of 82.5 feet to the mile (one and one half percent). The performance of B&O engine No. 71 is given as 117 trailing tons up a 2.2 percent grade at 18 miles per hour. Engine No. 71, a Camel, was built in April of 1851.

Failure analysis

White describes two known failures of Winans engines. The Huntington & Broad Top Mountain engine *Tuscarora*, delivered in March of 1863, suffered a boiler explosion in 1868. The *Minnesota*, delivered to the Philadelphia & Reading on October 28, 1850, suffered a crown sheet failure in 1851. Another incident occurred on the Cumberland & Pennsylvania Railroad's engine No. 22, which had come from the Cananadagua & Elmira, via the Northern Central. This engine suffered a boiler explosion in 1870, but was rebuilt and returned to service. A sister engine had no reported problems, but was pulled from service and rebuilt at the same time. This brings the known and documented catastrophic failure rate in Winans units to three units in 265, or a little more than one percent. All three documented failures were in Camel-type engines.³⁸

Non-catastrophic failures were more prevalent, but fewer were documented. For example, we know that service on the Maryland Mining Company Railroad's Eckhart Branch Railroad in western Maryland was hard, as evidenced by a series of correspondences with the Winans works in Baltimore. On June 16, 1856, they ordered a replacement right-hand crosshead for the engine *Braddock*. The *Braddock* had gone into service on July 1, 1854. On September 24, they needed the same part for the engine *Eckhart*. That engine had been placed into service on August 1, 1849. A frantic telegram on December 9, 1856, emphasizes the need for urgency for shipment of the replacement left-hand crosshead for the *Eckhart*.³⁹ The parts were to be delivered to the B&O Railroad at Cumberland.

War Damage

B&O engine No. 33, *Hercules*, was captured by Confederate forces in 1861, but returned in 1865. Engine No. 34, *Gladiator*, was also captured in 1861, but was never returned. Engine No. 108 was captured on June 17, 1863, and destroyed near Point of Rocks, Maryland. These were all Winans products.

It is hoped that this updated roster of Winans locomotive deliveries is of value to historians and researchers, and can be used a basis and impetus for future work. It is certainly not the final word.

endnotes

1. Ross Winans, Pocket Notebook, Collections of the Maryland Historical Society, Baltimore, Maryland, Folder 72, Box 23. The notebook covers the period June 8, 1848 to May 3, 1855. The Maryland Historical Society is located at 201 Monument St., Baltimore, Maryland 21201. Phone: 410-685-3750. A fee is charged to non-members for access to the collection.

2. This project started as an attempt to track the sales of locomotives to the early mining railroads in Allegany County, Maryland. Existing rosters and sources did not mention any such sales. The Winans records were researched, allowing compilations of rosters for two previously undocumented railroads. The information was published by Patrick H. Stakem in the Automatic Block, newsletter of the Western Maryland Chapter, National Railway Historical Society, Inc., Cumberland, Maryland, as "The Eckhart Branch Railroad, 1846-1870," January 1996 and "The Mount Savage Rail Road, 1845-1854," June 1995; reprinted in *Cumberland Times* Railfest Special Edition, September 30, 1995, "The Earliest Railroad Activities in Western Maryland, 1828-1870," *Journal of the Alleghenies*, 1995. See also Maryland Mining Company, George Wurtz Hughes, "Extracts from reports of an examination of the coal measures belonging to the Maryland mining company, in Allegany county; and of a survey for railroad from the mines to the Chesapeake and Ohio canal, at Cumberland," Washington: Printed by Gales and Seaton, 1837. This document is available at the Pratt Free Library, Baltimore, Maryland, call number HD9549.M3H8.

The Main Branch of the Pratt Free Library is located at 400 Cathedral St. Baltimore, Maryland. The relevant material is located in the Maryland Room on the 2nd floor. Curiously, the Enoch Pratt Free Library system of the City of Baltimore was built, stocked, and donated to the city by a Winans' supplier, Enoch Pratt. The following profile of Pratt is from *Dictionary of American Biography*, 1930, New York: Charles Scribner's Sons.

"Pratt (Sept. 10, 1808 - Sept.17, 1896) capitalist, friend of Andrew Carnegie. He was born in Massachusetts, and learned the ironmaking trade. He arrived in Baltimore in 1831 with \$150 in his pocket, and went on to make his fortune in hardware. Partner in E. Pratt & Brothers, 23-25 S. Charles St., Baltimore. Maryland Steamboat Co., Director, Susquehanna Canal Co., 27 yrs. Vice President of the Philadelphia, Wilmington, & Baltimore Railroad, director of three other railroads."

3. William G. LeFurgy, "Register of the Winans Papers at the Maryland Historical Society," Maryland Historical Society, Baltimore, Maryland, undated.

4. Patrick H. Stakem, "Ross Winans and the Baltimore Engines," Baltimore: The Bull Sheet, Feb. 1, 1996.

5. L.W. Sagle, "Ross Winans," R&LHS Bulletin No. 70, Feb. 21, 1947, and Winans Roster, courtesy, Thomas T. Taber III, Railroad Historical Resource Reference Center.

6. J. Snowden Bell. *The Early Motive Power of the B&O Railroad*, New York: Angus Sinclair Publishing; 1912; reprinted Felton, California: Glenwood Publishing, 1975, ISBN 0-911760-17-2; and "Report to P. E. Thomas, President, Baltimore & Ohio Railroad, on the Operation of Peter Cooper's Engine," by Winans, August 28, 1830.

7. Baltimore and Ohio Railroad Company. "Papers relative to the recent contracts for motive power, by the Baltimore and Ohio rail road co. and the reports of the officers of the different departments on the relative advantages of the Winans Camel engine, and the ten wheel engine, for the various branches of their service," 1857, Baltimore: Printed by J. Lucas and Son, (available at Pratt Library, Baltimore. Call Number:TJ690.B3).

8. "A Letter From Ross Winans To The President And Directors Of the Baltimore and Ohio Rail Road Co," 1857. (available at Pratt Library, Baltimore. Call Number: 17J690.W5). The Bartlett & Hayward (also know as Hayward & Bartlett) Company is documented in Ferdinand C. Latrobe, *Iron Men and Their Dogs*, Baltimore: Ivan R. Drachster, 1941. Originally a stove manufacturer, H&B got into the building of locomotives when they moved into Winans' old shops at Mt. Clare.

9. John H. White Jr., *A History of the American Locomotive Its Development 1830-1880*, Dover Publications, 1968; Reprinted 1979, ISBN 0-486-23818-0, and *A Short History of American Locomotive Building in the Steam Era*, Washington, D.C.: Bass Books, 1982.

10. Partial list of U.S. patents issued to Ross Winans:

- 305, 307, 308, 309, 311 of July 29, 1837
- 470 - firebox design, reissued June 16, 1857
- 1868 for variable exhaust, Nov. 26, 1840
- 3201 for engines built by Baldwin under license
- 5065 for variable exhaust, April 10, 1847
- 10901 for short & medium firebox engines, May 9, 1854
- 20177 for Camel engine, April 27, 1858.

11. George William Whistler, "Report Upon the Use of Anthracite Coal in Locomotive Engines on the Reading Rail Road, Made to the President of the Philadelphia And Reading Rail Road Company by George W. Whistler, Jr.," Baltimore: Printed by J. D. Toy, Pub. 1849, (available at Pratt Library, Baltimore). Whistler was involved with Winans and his sons on the Russian project.

12. William D. Edson, *Steam Locomotives of the Baltimore & Ohio An All Time Roster*, 1992, ISBN 0-9632913-0-0.

13. Roster of the Baltimore & Susquehanna, and of the Northern Central, courtesy, Thomas T. Taber III, Railroad Historical Resource Reference Center.

14. Thomas T. Taber III, Railroad Historical Resource Reference Center, personal communication.

15. Ibid.

16. H. Ray Hicks, "The Cumberland and Pennsylvania Railroad," *R&LHS Bulletin* No. 66, March, 1945, pp. 36-50; Deane Mellander, *Rails to the Big Vein, the Short Lines of Allegany County, Maryland*, Potomac Chapter, NRHS, Inc, January 1981; and Deane Mellander, *Cumberland and Pennsylvania Railroad*, 1981, Carstens Publishers, Inc., ISBN 911868-42-9.
17. James W Thomas, LL.D. and Judge T. J. C Williams, *History of Allegany County, Maryland*, Baltimore, Regional Publishing Co., 1923, reprinted 1969, pp. 626-628 (Millholland). Also, Patrick H. Stakem, "The Mt. Savage Locomotive Shops," *National Railway Historical Society Bulletin*, Spring/Summer issue, 1997.
18. Thomas T. Taber III, personal communication.
19. Delaware, Lackawanna, & Western Roster, pre-1899, courtesy, Thomas T. Taber III, Railroad Historical Resource Reference Center.
20. Roster of the Huntington & Broad Top Mountain RR, courtesy, Deane Mellander.
21. Thomas T. Taber III, personal communication.
22. Ibid.
23. Baltimore & Susquehanna Roster, op cite.
24. Thomas T. Taber III, personal communication.
25. Pennsylvania Railroad Roster, 1847-1877, courtesy, Thomas T. Taber III, Railroad Historical Resource Reference Center.
26. Columbia & Philadelphia, 1841 Annual Report, courtesy, Thomas T. Taber III, Railroad Historical Resource Reference Center.
27. Philadelphia & Reading Roster, reports of 1846, 1848, 1855, 1861, 1865, courtesy, Thomas T. Taber III, Railroad Historical Resource Reference Center.
28. Thomas T. Taber III, personal communication.
29. Ibid.
30. "History of the Baldwin Locomotive Works, 1831-1923," in Fred Westing, *The Locomotives that Baldwin Built*, New York: Bonanza Books, 1966; and John K. Brown, *The Baldwin Locomotive Works: 1831-1915*, Johns Hopkins Press.
31. Dr. Stephen Walters, Dept. of Economics, Loyola College, personal communication.

32. Newell (E. T.) Company. "Catalog of auction sale of all the remaining furniture, bric-a-brac, bronzes, statuary,.lot of books by foreign and American authors, etc., within the premises 'Alexandrofsky', former home of the Winans, Nov. 5, 1925,.by order of Miss Elsie C. Hutton," Baltimore, 1925. (available at Pratt Library, Baltimore. Call Number: NK570.B4).

33. A photo of C&P engine No. 2, previously *Highlander*, of the Mt. Savage Rail Road, in the J. G. Farrell collection illustrates this. Mr. Farrell was a fireman, engineer, and later Road Foreman of Engines on the Cumberland & Pennsylvania.

34. Philadelphia & Reading Roster, courtesy, Thomas T. Taber III, Railroad Historical Resource Reference Center.

35. J. Snowden Bell, op cite.

36. Annual Report of the Baltimore & Ohio Railroad Company, various. These are generally available in the research room of the B&O Museum at Mt. Clare, 901 W. Pratt St., Baltimore, Maryland 21223-2699.

37. "A Communication to the President and Directors of the Baltimore & Ohio Railroad Company, by Ross Winans, on the subject of Locomotive Engines for the Transportation of Freight on Railroads." Baltimore: printed by John D. Toy, 1856; and Ross Winans, "Address to the President and Directors of the Baltimore & Ohio Railroad Company on the Subject of Locomotive Engines, and the Errors in Relation Thereto, Contained in a Pamphlet Recently Published by Authority of the Company," Baltimore: printed by John D. Toy, 1857.

Additional information on the Seventeen mile grade, and its requirements on locomotives can be found in Charles S. Roberts, *West End, Cumberland to Grafton 1848-1991*, Baltimore, Maryland: Bernard, Roberts & Co., 1991; and James D. Dilts, *The Great Road The Building of the Baltimore & Ohio The Nation's First Railroad, 1828-1853*, Stanford University Press, 1993.

38. Some ancillary information can be found in E. Reuter, *American Locomotives*, 1849; and Zerah Colburn, *Recent Practice in Locomotive Engineering*, 1860.

39. in the Winans Papers at the Maryland Historical Society, Baltimore, Maryland.

Winans Engine Table

Table 2 shows the characteristics of the engines. The table is organized alphabetically by customer of delivery record. The table shows the name and/or identification number of the engine, the delivery date, and the type. The abbreviations md for muddigger and c for Camel are used in the type column. The table also lists the diameter and stroke of the pistons in inches, the driving wheel diameter in inches, and the engine weight in pounds. Where the information is not known, the entry is left blank. The table contains two hundred and sixty-six entries.

Generally, entries in the engine table were checked with at least two sources. However, the notebook covers only a limited period, and has gaps. It only has entries for the period June 8, 1848, to May 3, 1855, and there is a gap in dates between adjacent entries of September 1854 and March 1855. For sales before and after the period of the coverage of the notebook, we relied on the rosters of the known customers. There could be additional sales, not documented in the notebooks, and not currently known from the customer side. This is particularly true for single sales to obscure customers, or through brokers or facilitators such as Gouverneur Morris or Enoch Pratt who were not the final customer.

Winans delivery list

Customer	name/id	delivery	type	cyl.	whl	weight
Baltimore & Ohio	#32 Atalanta	10/1843	4-4-0	14 x 20	60	
Baltimore & Ohio	#33 Hercules	10/1844	0-8-0 md	17 x 24	33	47000
Baltimore & Ohio	#34 Gladiator	11/1844	0-8-0 md	17 x 24	33	47000
Baltimore & Ohio	#35 Buffalo	11/1844	0-8-0 md	17 x 24	33	47000
Baltimore & Ohio	#36 Baltimore	12/1844	0-8-0 md	17 x 24	33	47000
Baltimore & Ohio	#37 Cumberland	7/1845	0-8-0 md	17 x 24	33	47000
Baltimore & Ohio	#38 Elephant	7/1845	0-8-0 md	17 x 24	33	47000
Baltimore & Ohio	#39 Reindeer	12/1845	4-4-0	14 x 20	60	
Baltimore & Ohio	#40 Opequan	7/1846	0-8-0 md	17 x 24	33	47000
Baltimore & Ohio	#41 Elk	8/1846	0-8-0 md	17 x 24	33	47000
Baltimore & Ohio	#42 Catoctin	10/1846	0-8-0 md	17 x 24	33	47000
Baltimore & Ohio	#43 Youghiogheny	11/1846	0-8-0 md	17 x 24	33	47000
Baltimore & Ohio	#45 Tuscarora	12/1846	0-8-0 md	17 x 24	33	47000
Baltimore & Ohio	#46 Allegheny	12/1846	0-8-0 md	17 x 24	33	47000
Baltimore & Ohio	#52 Juno	1/1848	4-4-0	14 x 20	60	
Baltimore & Ohio	#55 Camel	6/8/1848	0-8-0 c	17 x 22	43	50400
Baltimore & Ohio	#59 Iris	12/11/1848	0-8-0 c	19 x 22	43	50000
Baltimore & Ohio	#61 Mars	12/21/1848	0-8-0 c	19 x 22	43	50000
Baltimore & Ohio	#65 Phoenix	9/26/1850	0-8-0 c	19 x 22	43	58000
Baltimore & Ohio	#66 Apollo	9/1850	0-8-0 c	19 x 22	43	58000
Baltimore & Ohio	#68 Savage	10/28/1850	0-8-0 c	19 x 22	43	58000
Baltimore & Ohio	#69 Pilot	11/11/1850	0-8-0 c	19 x 22	43	58000
Baltimore & Ohio	#70	3/17/1851	0-8-0 c	19 x 22	43	56000
Baltimore & Ohio	#71	4/22/1851	0-8-0 c	19 x 22	43	56000
Baltimore & Ohio	#73	6/18/1851	0-8-0 c	19 x 22	43	56000
Baltimore & Ohio	#74	6/19/1851	0-8-0 c	19 x 22	43	56000

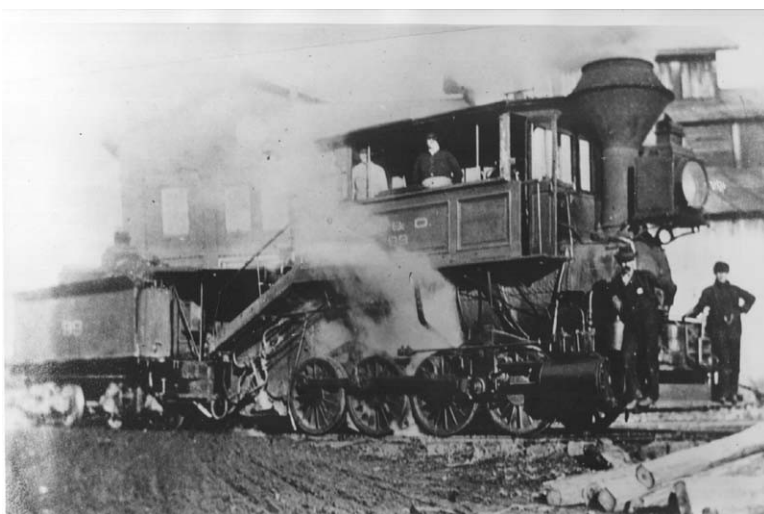
Baltimore & Ohio	#75	8/20/1851	0-8-0 c	19 x 22	43	56000
Baltimore & Ohio	#77	8/21/1851	0-8-0 c	19 x 22	43	56000
Baltimore & Ohio	#78	9/3/1851	0-8-0 c	19 x 22	43	56000
Baltimore & Ohio	#79	9/4/1851	0-8-0 c	19 x 22	43	56000
Baltimore & Ohio	#80	9/23/1851	0-8-0 c	19 x 22	43	56000
Baltimore & Ohio	#81	10/1/1851	0-8-0 c	19 x 22	43	56000
Baltimore & Ohio	#82	10/17/1851	0-8-0 c	19 x 22	43	56000
Baltimore & Ohio	#84	11/15/1851	0-8-0 c	19 x 22	43	74700
Baltimore & Ohio	#85	12/6/1851	0-8-0 c	19 x 22	43	74700
Baltimore & Ohio	#86	1/10/1852	0-8-0 c	19 x 22	43	74700
Baltimore & Ohio	#87	1/10/1852	0-8-0 c	19 x 22	43	74700
Baltimore & Ohio	#88	1/30/1852	0-8-0 c	19 x 22	43	74700
Baltimore & Ohio	#90	1/30/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#91	2/16/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#92	2/24/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#93	3/16/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#94	3/22/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#96	4/1/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#97	4/9/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#98	5/4/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#100	7/10/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#101	7/16/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#102	8/2/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#103	8/9/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#104	8/16/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#105	9/6/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#106	9/13/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#108	9/27/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#109	10/4/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#110	10/11/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#111	10/18/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#112	10/23/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#113	10/28/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#114	11/3/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#115	11/15/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#116	11/27/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#117	12/3/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#118	12/18/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#119	12/18/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#120	12/20/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#121	12/27/1852	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#123	1/4/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#124	1/10/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#125	1/14/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#128	1/25/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#130	1/29/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#132	3/4/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#133	4/8/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#134	4/15/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#135	4/20/1853	0-8-0 c	19 x 22	43	

Baltimore & Ohio	#136	4/26/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#137	4/29/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#140	5/4/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#141	5/9/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#143	5/12/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#144	5/16/1853	0-8-0 c	19 x 22	43	74700
Baltimore & Ohio	#145	5/23/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#146	5/28/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#147	6/1/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#148	6/4/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#150	6/9/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#152	6/11/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#154	6/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#155	6/1853	0-8-0 c	19 x 22	43	74700
Baltimore & Ohio	#156	6/16/1853	0-8-0 c	19 x 22	43	74700
Baltimore & Ohio	#157	6/23/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#160	6/28/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#161	7/8/1853	0-8-0 c	19 x 22	43	74700
Baltimore & Ohio	#162	7/13/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#163	7/19/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#168	10/12/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#169	10/12/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#170	10/12/1853	0-8-0 c	19 x 22	43	
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Baltimore & Ohio	#181	10/22/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#182	10/22/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#183	10/29/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#184	11/3/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#185	11/12/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#186	11/22/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#187	11/29/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#188	12/6/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#189	12/12/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#190	12/19/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#191	12/22/1853	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#192	1/2/1854	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#193	1/9/1854	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#194	1/16/1854	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#195	1/25/1854	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#196	2/28/1854	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#197	2/7/1854	0-8-0 c	19 x 22	43	

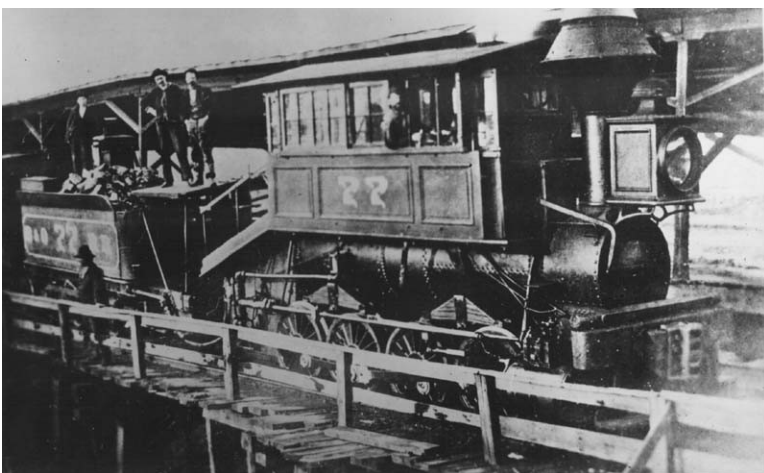
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Baltimore & Ohio	#211	2/1857	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#212	2/1857	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#213	2/1857	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#214	2/1857	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#215	2/1857	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#216	2/1857	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#217	2/1857	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#218	2/1857	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#219	2/1857	0-8-0 c	19 x 22	43	
Baltimore & Ohio	#199 (2nd)	1863	0-8-0 c	19 x 22	43	62000
Baltimore & Ohio	#188 (3rd)	1863	0-8-0 c	19 x 22	43	62000
Baltimore & Ohio	#204 (2nd)	1863	0-8-0 c	19 x 22	43	62000
Baltimore & Ohio	#235 Centipede	1863	4-8-0	22 x 22	43	58000
Baltimore & Susquehanna	Major T. Whistler	9/22/1849	4-4-0	14 1/4 x 18	60	
Baltimore & Susquehanna	J. Edgar Thompson	3/11/1851	0-8-0 c	19 x 22	41	57200
Baltimore & Susquehanna	Robert M. Magraw	4/19/1851	0-8-0 c	19 x 22	42	57300
Baltimore & Susquehanna	Daniel Webster	7/15/1851	0-8-0 c	19 x 22	42	57000
Baltimore & Susquehanna	John S. Gittings	10/28/1851	0-8-0 c	19 x 22	42	57300
Baltimore & Susquehanna	#5	2/14/1852	0-8-0 c	19 x 22	42	57300
Baltimore & Susquehanna	#6	8/31/1852	0-8-0 c	19 x 22	42	57300
Baltimore & Susquehanna	#8	11/10/1852	0-8-0 c			
Baltimore & Susquehanna	#10	2/8/1853	0-8-0 c	19 x 22	42	57300
Baltimore & Susquehanna	#11	3/14/1853	0-8-0 c	19 x 22	42	57300
Boston & Worcester	Carroll of Carrollton	10/6/1849	4-2-4		84	
Boston & Maine	Boston	4/1/1849	0-8-0 c			
Cleveland & Pittsburg	Carroll	5/25/1852	0-8-0 c	19 x 22	42	
Cleveland & Pittsburg	Jefferson	7/23/1852	0-8-0 c	19 x 22	42	
Cumberland Coal & Iron	Black Monster	9/20/1852	0-8-0 c	19 x 22	43	74,300
Cumberland Coal & Iron	Cumberland	5/28/1853	0-8-0 c	19 x 22	43	74,300
Cumberland Coal & Iron	Braddock	7/1/1854	0-8-0 c	17 x 22	43	
Cumberland & Pennsylvania	#9 William Delano	1863	0-8-0 c	19 x 22	43	74,300
Cumberland & Pennsylvania	#10 Enoch Pratt	1863	0-8-0 c	19 x 22	43	74,300
Cumberland & Pennsylvania	#11 C.E. Detmold	1863	0-8-0 c	19 x 22	43	74,300
Cumberland & Pennsylvania	#12 M.B. Bramhall	1863	0-8-0 c	19 x 22	43	74,300
Cumberland & Pennsylvania	#13 A.C. Green	1863	0-8-0 c	19 x 22	43	74,300
Dauphin & Susquehanna	Dauphin	8/27/1852	0-8-0 c			
Dauphin & Susquehanna Coal	Gold Mine	3/16/1854	0-8-0 c			
Dauphin & Susquehanna Coal	Raush Gap	3/22/1854	0-8-0 c			60,000
Dauphin & Susquehanna Coal	Yellow Spring	5/2/1854	0-8-0 c			60,000
Delaware, Lackawanna & Western	#16 Carbon	9/26/1854	0-8-0	15 x 20	51	70,000
Delaware, Lackawanna & Western	#32 Maryland	1856	0-8-0	15 x 20	51	70,000
Delaware, Lackawanna & Western	#34 Virginia	1856	0-8-0	15 x 20	52	70,000
Delaware, Lackawanna & Western	#38 Vermont	1856	0-8-0	15 x 20	51	70,000
Delaware, Lackawanna & Western	#46 Michigan	1856	0-8-0	15 x 20	51	70,000
Delaware, Lackawanna & Western	#42 Connecticut	1856	0-8-0	15 x 20	51	70,000

Canandagua & Elmira	#1	1856-1867	0-8-0 c	19 x 22	43	69,800
Canandagua & Elmira	#2	1856-1867	0-8-0 c	19 x 22	43	69,800
Gouverneur Morris of Morrisania		9/6/1957	0-8-0 c			
Huntington & Broad Top Mt.	Tuscarora	3/1863	0-8-0 c	19 x 22	43	
Huntington & Broad Top Mt.	Oneida	3/1863	0-8-0 c	19 x 22	43	
Maryland Mining Co.	Eckhart	8/1/1849	0-8-0 c	17 x 22	43	47,000
Maryland Mining Co.	Mountaineer	12/1/1849	0-8-0 c	19 x 22	43	74,300
Maryland Mining Co.	Fire King	6/30/1851	0-8-0 c			
Mt. Savage Iron & Coal	Highlander	7/30/1852	0-8-0 c	19 x 22	43	57400
Mt. Savage Iron & Coal	Frostburg	11/20/1852	0-8-0 c	19 x 22	43	57400
Mt. Savage Iron & Coal	John Galloway Lynn	7/12/1853	0-8-0 c	19 x 22	43	57400
Mt. Savage Iron Co.	New York	4/18/1850	0-8-0 c			
Mt. Savage Rail Road	Mt. Savage	1848	0-8-0 c	17 x 22	43	50400
New York & Erie	#88	5/1851	0-8-0 c	19x22	43	56000
New York & Erie	#89	5/16/1851	0-8-0 c	19x22	43	56000
New York & New Haven RR	#27 - see note	7/3/1854	0-8-0 c			
New York & New Haven RR	#28 - see note	8/29/1854	0-8-0 c			
Northern Central	#27	1855	0-8-0 c	19 x 22	42	60,000
Northern Central	#28	1855	0-8-0 c	19 x 22	42	60,000
Northern Central	#29	1855	0-8-0 c	19 x 22	42	60,000
Northern Central	#30	1855	0-8-0 c	19 x 22	42	60,000
Northern Central	#31	1855	0-8-0 c	19 x 22	42	60,000
Northern Central	#32	1855	0-8-0 c	19 x 22	42	60,000
Northern Central	#39	1858	0-8-0 c	19 x 22	42	60,000
Northern Central	#40	1858	0-8-0 c	19 x 22	42	60,000
Northern Central	#41	1858	0-8-0 c	19 x 22	42	60,000
Northern Central	#42	1858	0-8-0 c	19 x 22	42	60,000
Pennsylvania Railroad	#48 Pluto	1/25/1853	0-8-0 c	19 x 22	44	59,100
Pennsylvania Railroad	#50 Vulcan	2/2/1853	0-8-0 c	19 x 22	44	58,500
Pennsylvania Railroad	#51 Cyclops	2/8/1853	0-8-0 c	19 x 22	44	61,700
Pennsylvania Railroad	#52 Thor	4/2/1853	0-8-0 c	19 x 22	44	59,150
Pennsylvania Railroad	#88 Mountaineer	2/4/1854	0-8-0 c	19 x 22	44	61,200
Pennsylvania Railroad	#91 Logan	2/18/1854	0-8-0 c	19 x 22	44	59,150
Pennsylvania Railroad	#119 Corn Planter	1/1856	0-8-0 c	19 x 22	44	58,500
Pennsylvania Railroad	#140 Mohawk	4/1856	0-8-0 c	19 x 22	44	59,150
Pennsylvania Railroad	#124 Oneida	2/1856	0-8-0 c	19 x 22	44	59,500
Pennsylvania Railroad	#121 Red Jacket	1/1856	0-8-0 c	19 x 22	44	59,500
Pennsylvania Railroad	#131 Seneca	4/1856	0-8-0 c	19 x 22	44	58,500
Philadelphia & Columbia RR	#3 Baltimore	1837	0-4-0			22,400
Philadelphia & Columbia RR	#30 W.F. Packer	1840				40,320
Philadelphia & Reading RR	Baltimore	9/1846	0-8-0 c			62,700
Philadelphia & Reading RR	Ohio	10/1846	0-8-0 c			62,700
Philadelphia & Reading RR	Maryland	10/1846	0-8-0 c			62,700
Philadelphia & Reading RR	Delaware	10/1846	0-8-0 c			62,700
Philadelphia & Reading RR	American	10/1/1850	0-8-0 c			
Philadelphia & Reading RR	Patapsco	10/21/1850	0-8-0 c	17 x		55,100
Philadelphia & Reading RR	Minnesota	10/28/1850	0-8-0 c	17 x		50,400
Philadelphia & Reading RR	Iowa	10/28/1851	0-8-0 c			56,900
Philadelphia & Reading RR	Wisconsin	11/3/1851	0-8-0 c			56,500
Philadelphia & Reading RR	New Jersey	3/13/1852	0-8-0 c			57,100

Philadelphia & Reading RR	Mississippi	4/29/1852	0-8-0 c			59,300
Philadelphia & Reading RR	Connecticut	5/24/1852	0-8-0 c			59,300
Philadelphia & Reading RR	New Hampshire	6/1/1852	0-8-0 c			59,300
Philadelphia & Reading RR	Utah	6/19/1852	0-8-0 c			58,700
Philadelphia & Reading RR	Monongahala	2/27/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Tamaqua	3/10/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Saranak	3/24/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Susquehanna	3/31/1854	0-8-0 c	19 x 22	43	60,500
Philadelphia & Reading RR	Chippeway	4/11/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Colorado	4/15/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Narraganset	4/25/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Penobscot	5/10/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Kennabec	5/15/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Nebraska	5/19/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Santee	5/21/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Shenandoah	5/27/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Cumberland	6/2/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Potomac	6/13/1854	0-8-0 c			60,500
Philadelphia & Reading RR	Savannah	6/19/1854	0-8-0 c			60,000
Philadelphia & Reading RR	Celeste	7/31/1854				65,600
Philadelphia & Reading RR	Pottsville	3/21/1855	0-8-0 c			60,000
Philadelphia & Reading RR	Arkansas	3/26/1855	0-8-0 c			60,000
Philadelphia & Reading RR	Rhode Island	3/27/1855	0-8-0 c			60,000
Philadelphia & Reading RR	Germantown	3/28/1855	0-8-0 c			60,000
Philadelphia & Reading RR	Harrisburg	3/29/1855	0-8-0 c			60,000
Philadelphia & Reading RR	Lexington	4/2/1855	0-8-0 c			60,000
Philadelphia & Reading RR	San Francisco	4/4/1855	0-8-0 c			60,000
Philadelphia & Reading RR	Ashland	4/5/1855	0-8-0 c			60,000
Philadelphia & Reading RR	Mt. Vernon	4/9/1855	0-8-0 c			60,000
Philadelphia & Reading RR	Buffalo	4/11/1855	0-8-0 c			60,000
Philadelphia & Reading RR	Richmond	4/19/1855	0-8-0 c			60,000
Philadelphia & Reading RR	Panama	5/3/1855	0-8-0 c			60,000
Philadelphia & Reading RR	Georgia	1850	0-8-0 c			54,000
Philadelphia & Reading RR	Louisiana	1850	0-8-0 c			53,500
Philadelphia & Reading RR	Wilmington	1855	0-8-0 c			60,000
Philadelphia & Reading RR	Charlestown	1855	0-8-0 c			60,000
Philadelphia & Reading RR	Albany	1855	0-8-0 c			60,000
Pittsburgh & Connellsville	#3	4/1857	0-8-0 c	19 x 22	43	
Shamokin Valley & Pottsville	#4	1858	0-8-0C			60,000
South Carolina RR	#6 Rough & Ready	8/7/1847	4-4-0	14 x		
Trevorton & Susquehanna RR		7/12/1854	0-8-0 c			
Western (Mass.) RR	Maryland	1841		14.5 x 24		44,000
Western (Mass.) RR	Michigan	Dec. 1841	0-8-0			
Western (Mass.) RR	Illinois	Feb. 1842	0-8-0			
Western (Mass.) RR	Ohio	June 1842	0-8-0			



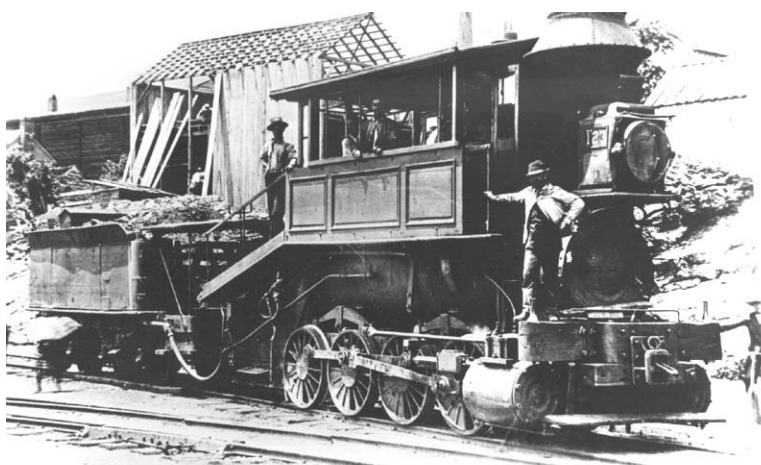
1. B&O Number 99 at work in Cumberland, Maryland, in 1860, Howard K. Vollrath Collection.



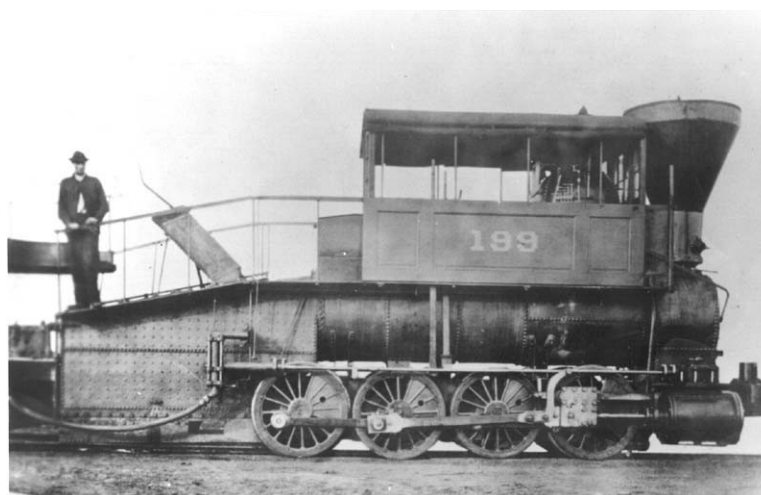
2. C&P's *Highlander*, rebuilt at the Mt. Savage shops in 1868. John Butler, Engineer, Jas. Waggle, Fireman. J. G. Farrell Collection.



3. B&O No. 123 in Baltimore in 1865, Howard K. Vollrath Collection.



4. B&O No. 111 with a work train enroute to Cumberland, 1860, Howard K. Vollrath Collection.



5. B&O No. 77 at Cumberland, Maryland, in 1861, Howard K. Vollrath Collection.



6. B&O No. 199 with the long firebox configuration, William P. Price Collection. This picture was made at Mt. Clare in 1863 by R. K. McMurray, Chief Inspector of the Hartford Steam Boiler Inspection and Insurance

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Note:

Stakem, Patrick H. and Stakem, Patrick E. From the (Iron) Horse's Mouth: An updated Roster from Ross Winans' *Memorandum of Engines*, First Printing

Mr. Winans obituary was printed in the New York Times, April 27, 1877, and is available online.

Winans Patents relating to locomotives

There are two major categories of patents that were filed by Ross Winans, and his sons: the railroad related ones, and the ones for his ships. The connection between the two is the use of steam for motive power.

This is not necessarily a complete list of his railroad-related patents. Following the patents in chronological order, we can see a development progression, leading to the Camel design.

Patent 305, dated July 29, 1837, is concerned with the framing of a locomotive steam engine. The drawings show an ornate vertical boiler locomotive, with 4 driven wheels. The basis of the claim is a way to mount the cylinders and provide strength and stiffness in the frame. This is the *Crab* design.

Patent 307, also 1837, is concerned with a device to use the exhaust ("waste") steam to heat the incoming water for the boiler, and to provide a controllable draft for the fire. A reference to the use of "force pumps" for water injection to the boiler is made.

Patent 308, 1837, is concerned with the overall design of “the Baltimore engines,” the B&O design that differed from the English design. The overall design uses a combination of a vertical boiler and horizontal cylinders. Spur and pinion intermediate gears are used in the drive train.

Patent 309, 1837, covers the design of a feed-water heater. Patent 311 addresses “locomotive steam-engines adapted to undulating and curved roads.” It was beginning to be realized that locomotive engines took a beating on the early lines, as opposed to stationary engines. The patent describes a variable cut-off steam system, using cams. This design advocates Winans’ principle of using all the wheels to drive the locomotive.

Patent 1,868 in 1840 addressed a mechanism to regulate the waste steam to control the draft in the locomotive. Patent 3201, 1843, starts hinting at the Camel design. The drawing shows an 8-wheeled locomotive, although with a vertical boiler. Patent 4812 of 1843 discusses improvements to locomotives of 6 or 8 driving wheels. Winans alludes to the design of Hopkins Thomas for the Beaver Meadow Railroad. Also, for weight equalization, he alludes to a patent of Eastwick and Harrison. The drawings show 6- and 8-wheeled locomotives with horizontal boilers, beginning to look like Camels.

Patent 5056 of 1847 discusses the design of the steam exhaust pipes to increase the draft in the firebox. Patent 5175 of 1847 covers the design of coal cars that carry loads greater than its own weight, a big design feature. The “pot” hoppers are also bottom-dumping. One of the witnesses to the patent is George W. Whistler, Jr. Winans was related to James McNeill Whistler (the painter) through marriage (Whistler's brother George married Winans' daughter Julia).

Patent 8571 of 1851 covers the running gear of a locomotive. He advocates steam-springs for alleviating bumps and bounces, essentially, hydraulic shock absorbers using steam. Some of the parameters he uses for the engine are 80-psi steam, 17-inch diameter driving cylinder, 22-inch power stroke, all very similar to the subsequent Camels. The drawing shows a strange 4-2-4 wheel arrangement. This was the design of the “Carroll of Carrollton delivered to the Boston & Worcester, but returned to Winans 1851-52.

Patent 10634 of 1854 again discusses the design of exhaust steam nozzles. Patent 10901 of 1854 covers the design of the firebox. Here we see clearly the Camel locomotive design. He says, “The most striking difference will be recognized in the length of the firebox, and its peculiar shape.” Patent 10971 continues the discussion of the tender design, to allow the fireman to feed the “peculiar” firebox. Patent 10971 discusses improvements to the tender design. Patent 19,889 of 1858 discusses improvements to the firebox, grate, and ashpan. Patents 19890 and 20114 discuss the grate. Patent 20115 covers the firebox design, and 20116, the boiler. Here, we see the claim of “...staying the crown-sheet directly to the exterior shell by means of through bolts...” Patent 20117 covers the furnace design.

Patent 21290 discusses the unique smokestack, with the catch-box for cinders. Patent 22597 covers improvements to the design.

After 1859, Winans' attention shifted from railroad locomotive improvements, to the design of his "Cigar ships." Several of these unique vessels were built, at the Winans Shipyards in Baltimore, in London, and in Le Havre in France. These included the steam yachts *Walter S. Winans* and the *Ross Winans*. There is the possibility that these ships were the basis for Jules Verne's *Nautilus*. Could Winans have been a model for Captain Nemo?